

Quantifying Natural Source Zone Depletion Rates for Confined LNAPL

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Background/Objectives. Extensive research and development have been conducted and published by numerous practitioners presenting multiple methods to quantify natural source zone depletion (NSZD) rates for LNAPL. However, to date these methodologies have not evaluated or incorporated adjustments for LNAPL hydrogeologic condition, in particular for confined LNAPL. Confined LNAPL can exist near the top of the saturated zone where both water and LNAPL are confined, or within the saturated zone where only the LNAPL is confined. In order to obtain stakeholder approval for implementation of NSZD for confined LNAPL, an evaluation of the impact of confining conditions on LNAPL NSZD was required.

Approach/Activities. Well conceptual models (WLCMs) were constructed from existing well construction, lithology, gauging, CPT/LIF data and other borehole parameters from multiple wells to ensure LNAPL was present under confined conditions and to identify the location of the Mobile NAPL Interval(s). Multiple methods were implemented to evaluate and compare NSZD measured rates. Methods included use of carbon traps, thermal profiling, and dissolved gas analysis. NSZD rates for each method were quantified and compared to each other, and to historical well gas NSZD screening values. In addition, a new plume-scale method was evaluated for comparison. The comparison was conducted in a small number of wells prior to site-wide implementation.

Results/Lessons Learned. Results demonstrated that thermal profiling provided the most reliable identification and quantification of NSZD for confined LNAPL. Dissolved gas analysis provided a strong line of evidence that NSZD had occurred, but quantification of the rates was challenging. Surface carbon traps exhibited lower rates and interference from vadose zone residual NAPL degradation that was not representative of the confined LNAPL mobile NAPL interval(s).